

WHAT IS CLAIMED IS:

1. A coplanar waveguide biosensor for detecting molecular or cellular events, comprising:

a one-port coplanar waveguide transmission line operable to support the propagation of a electromagnetic test signal, comprising:

a signal line configured to conduct a time-varying voltage therealong;

and

one or more ground elements configured to maintain a time-invariant voltage therealong, the one or more ground elements spaced apart from the signal line and located generally within the same plane as the signal line, wherein a detection region is formed between a portion of the signal line and a portion of at least one of the one or more ground elements; and

a sample containment structure intersecting the detection region of the one-port coplanar waveguide transmission line, wherein the sample containment structure comprises a cavity operable to hold 1 ml or less of sample solution within the detection region.

2. The coplanar waveguide biosensor of claim 1, wherein the sample containment structure comprises a well structure.

3. The coplanar waveguide biosensor of claim 1, wherein the sample containment structure comprises a fluid channel.

4. The coplanar waveguide biosensor of claim 1, wherein the sample containment structure comprises a flow tube.

5. The coplanar waveguide biosensor of claim 1, wherein the signal line comprises a tapered section.

6. The coplanar waveguide biosensor of claim 1, wherein the one or more ground elements comprises a tapered section.

7. The coplanar waveguide biosensor of claim 1, wherein the signal line comprises a tapered section and the one or more ground elements comprises a tapered section.

8. The coplanar waveguide biosensor of claim 1, wherein the coplanar waveguide transmission line comprises a resonant structure.

9. The coplanar waveguide biosensor of claim 1, further comprising a molecular event electromagnetically coupled to the signal line.

10. The coplanar waveguide biosensor of claim 9, wherein the molecular event is directly or indirectly physically attached to the coplanar waveguide transmission line within the detection region

11. The coplanar waveguide biosensor of claim 9, wherein the molecular event is separated from the coplanar waveguide transmission line within the detection region.

12. The coplanar waveguide biosensor of claim 1, further comprising a cellular event electromagnetically coupled to the signal line.

13. The coplanar waveguide biosensor of claim 12, wherein the cellular event is directly or indirectly physically attached to the coplanar waveguide transmission line within the detection region

14. The coplanar waveguide biosensor of claim 12, wherein the cellular event is separated from the coplanar waveguide transmission line within the detection region.

15. A coplanar waveguide biosensor test system, comprising:
a signal source operable to output an electromagnetic test signal;
a one-port coplanar waveguide transmission line electrically coupled to the signal source and operable to support the propagation of an electromagnetic signal,
comprising:

a signal line configured to conduct a time-varying voltage therealong;

and

one or more ground elements configured to maintain a time-invariant voltage therealong, the one or more ground elements spaced apart from the signal line and located generally within the same plane as the signal line, wherein a detection region is formed between a portion of the signal line and a portion of at least one of the one or more ground elements; and

a sample containment structure intersecting the detection region of the one-port coplanar waveguide transmission line, wherein the sample containment structure comprises a cavity operable to hold 1 ml or less of sample solution within the detection region; and

a signal detector electrically coupled to the coplanar waveguide signal line.

16. The coplanar waveguide biosensor test system of claim 15, wherein the signal detector comprises a network analyzer.

17. The coplanar waveguide biosensor test system of claim 15, wherein the signal detector comprises a vector voltmeter.

18. The coplanar waveguide biosensor test system of claim 15, wherein the signal source is operable to output one or more signals from 300 KHz to 3 GHz.

19. The coplanar waveguide biosensor test system of claim 15, wherein the signal source is operable to output one or more signals from 45 MHz to 26 GHz.

20. A coplanar waveguide biosensor for detecting molecular or cellular events, comprising:

a two-port coplanar waveguide transmission line operable to support the propagation of an electromagnetic test signal, comprising:

a signal line configured to conduct a time-varying voltage therealong;
and

one or more ground elements configured to maintain a time-invariant voltage therealong, the one or more ground elements spaced apart from the signal line and located generally within the same plane as the signal line, wherein a detection region is formed between a portion of the signal line and a portion of at least one of the one or more ground elements; and

a sample containment structure intersecting the detection region of the one-port coplanar waveguide transmission line, the sample containment structure comprising:

a cavity operable to hold 1 ml or less of sample solution within the detection region; and

at least one sample port operable to supply the sample solution to the cavity.